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Issued January 13, 1908.

U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF THE

CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY

FOR

1907.

BY

C. HART MERRIAM,
CHIEF.

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CONTENTS.

	Page.
The work of the Biological Survey	3
Economic ornithology and mammalogy	3
Geographic distribution	8
Game protection	10
Routine work	16
Publications	17
Outline of work for 1908	18
Economic ornithology and mammalogy	18
Geographic distribution	20
Game protection	21
Recommendations	23

REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., August 10, 1907.

Sir: I have the honor to transmit herewith a report of the work of the Biological Survey for the fiscal year ended June 30, 1907, with outline of work for 1908, and recommendations for 1909.

Respectfully,

C. Hart Merriam,
Chief.

Hon. James Wilson, *Secretary.*

THE WORK OF THE BIOLOGICAL SURVEY.

The work of the Biological Survey as laid down by Congress is conducted under three general heads: (1) Investigation of the economic relations of birds and mammals to agriculture; (2) investigations concerning the geographic distribution of animals and plants with reference to the determination of the life and crop belts of the country; (3) supervision of matters relating to game preservation and protection, and the importation of foreign birds and animals.

ECONOMIC ORNITHOLOGY AND MAMMALOGY.

No part of the work of the Survey is of more immediate practical importance than the study of the relations of birds and mammals to agriculture. Our growing population, due to the natural increase of our own people and to the army of immigrants coming to the United States in ever-augmenting numbers, will soon require that every acre of available land be devoted to the raising of crops. The need of a vast quantity of foodstuff for home consumption is still further emphasized by demands from abroad. In response to the necessity for additional food supplies, irrigation is now making available thousands of acres hitherto classed as worthless for cultivation and of but little value even as grazing lands. New and valuable food plants are being introduced from every quarter of the globe. Unfortunately new insect pests also, like the boll weevil, find their way into the country and threaten the prosperity of whole regions. In the war against such pests birds have always played an important part. That they will play a still more important part in the future can not be doubted, and it is desirable that the farmer shall understand the exact nature of their services; for while some

birds are always the farmers' friends and do no appreciable harm, others ofttimes display injurious traits, and there are still others whose habits require careful investigation in order to determine whether on the whole they are to be classed as friends or foes and whether the farmer should protect or destroy them.

Moreover, from a variety of causes, the useful birds of the United States are not increasing in numbers. On the contrary, in many sections they are diminishing with sufficient rapidity to cause apprehension on the part of those who have the future prosperity of the country at heart. The destruction of nesting sites when large forested areas are cut for timber, or devastated by fire, the destruction of vast numbers of birds for millinery purposes and for food, the wanton destruction of birds by boys provided with cheap firearms, together with the robbing of nests (a far commoner practice than is generally understood); these causes, together with the English sparrow, which is rapidly driving away swallows and other useful birds, all tend to one end—a reduction in the numbers of our useful birds—and this at a time when they are becoming of more and more value to the farmer. Hence the necessity for careful study of all available means of protecting birds, of methods devised to attract useful kinds to the farm, and of means of increasing their numbers in every way possible.

The practical problems in relation to the wild mammals of the United States are no less important. Certain mammals, as bats, skunks, weasels, foxes, and moles, are either wholly beneficial or so nearly so as to permit their being classed as such for practical purposes. A much larger class, including nearly all the smaller rodents—rats, mice, gophers, ground squirrels, and rabbits—is everywhere injurious, as also are wolves and panthers. It is to the study of the best and cheapest methods of accomplishing the destruction of these pests that the assistants of the Survey are devoting much time and attention.

PREVENTIVE MEASURES AGAINST MAMMALS.

Experiments with poisons to destroy coyotes, rabbits, ground squirrels, rats, and mice have been continued during the year. Experiments have been made in cooperation with sheep owners in the West for the purpose of fencing sheep from coyotes. Owing to lack of funds it was found impossible to carry out these experiments on the desired scale, and they were temporarily discontinued. The subject, however, is assuming new importance, owing to the ravages of both coyotes and wolves over large areas in the West, and during the coming year practical tests will be made, in connection with the Forest Service, of a fence which it is believed will not only prove an adequate protection from both wolves and coyotes, but will be cheap enough to insure its adoption in wolf and coyote infested districts.

WOLVES.

As stated last year, the problem of ridding the National Forests and cattle ranges of the West of gray wolves was taken up by the Biological Survey at the request of and in cooperation with the Forest Service. As the result of investigations by one of the assistants of

the Survey, a preliminary bulletin was issued, followed later by a circular setting forth practical methods of reducing the number of wolves. Both these publications were widely distributed to forest rangers, ranchmen, hunters and trappers in the wolf-infested regions.

The depredations of wolves are not limited to the western stock ranges. So numerous have timber wolves become in the upper peninsula of Michigan and in northern Wisconsin and Minnesota as to threaten extermination of the deer. At the request of owners of large tracts of forest land and of sportsmen, an assistant of the Survey visited the region for the purpose of studying the problem on the ground and of devising methods to abate the evil. As a result, practical suggestions for destroying wolves were set forth in a circular which has been widely distributed in the above-named States.

Following the adoption of the methods recommended, especially that of destroying the pups in the breeding dens, so many wolves have been killed that the saving of stock this year amounts to at least a million dollars, and it is believed that persistent efforts will result in a permanent reduction of the numbers of these destructive animals, if not their practical extermination in the cattle country. Their absolute and final extermination will probably not be practicable so long as extensive tracts of wild land remain to afford them harborage.

HOUSE RATS.

One of the most important pieces of work of the year is an investigation of the most practical methods of destroying house rats. Despite the incessant warfare waged against them for centuries, these destructive rodents continue to thrive and multiply almost unchecked in every civilized country. The damage they do in the United States is very great, and amounts to millions of dollars every year. As a result of experiments with various traps and poisons it is believed that practical means of reducing the numbers of the pest have been found, and a bulletin on the subject has been prepared and issued.

BACTERIAL DISEASES.

The study of bacterial diseases for the destruction of mammals, in cooperation with the Bureau of Animal Industry, has been continued. This is a comparatively new field, with few precedents to serve as guides in overcoming the difficulties in the way of immediate success. Nevertheless the field is a promising one. It is known that within a few years successive epidemics in various parts of the United States have so decimated the ranks of rabbits and ground squirrels that for several years these animals have ceased to be pests over wide regions. After an epidemic has run its course the particular rodent affected gradually increases in numbers till it once more becomes an economic factor of importance. The purpose of the present investigation is the discovery of the epidemic disease peculiar to each species of rodent, with a view to its utilization in reducing the numbers of crop pests wherever they occur. Such studies have been carried farther in European countries than in our own, and one of several bacterial cultures which have been placed on both the home and the foreign market and widely advertised has been carefully experimented with, chiefly in the laboratory, to test its efficacy on some

of our American rodents. The results of laboratory experiments have been fairly encouraging, but up to the present time field experiments have been disappointing. When fatal results have followed the placing out of infected food, the effects seem to be limited wholly to the individuals eating the infected bait and little or no tendency to spontaneous spread of the disease is exhibited. Thus limited, the disease as a means of destroying rodents is in no wise superior to mineral and other poisons, and in some respects, as certainty of action and the power to retain virulence in hot weather, is decidedly inferior.

Cultures from only one native disease have thus far been obtained. Several years ago this greatly reduced the numbers of one of the smaller ground squirrels of Washington. Since the prevalence of this epidemic the animal has again vastly increased, until now the damage to wheat by its depredations amount to many thousands of dollars yearly. During the present year extensive field experiments were made with cultures of this disease in cooperation with the State experiment station at Pullman, but so far the object arrived at—the production of an epidemic over the extensive area infested by ground squirrels—has not been attained.

Pending the discovery of additional epidemic diseases native to this country, and of methods for their practical utilization in the manner indicated, the best means of keeping rodent pests in check are by the use of poisoned food and of gases for killing the animals in their burrows. Careful experiments have been made along these lines with a view to the discovery of the most effective and the cheapest agents. In States where poison is used annually by thousands of pounds, economy of dose is important. A report setting forth the results of experiments will soon be ready for distribution.

EXAMINATION OF BIRD STOMACHS.

Field investigations and laboratory examinations of the food of birds are carried on simultaneously for the double purpose of ascertaining exactly what each bird eats and of furnishing field assistants valuable hints as to the birds most profitable to study. With the small force now available it is impossible to do much more than keep abreast of the current work, and a large number of stomachs that have accumulated from year to year still remain to be examined. It is hoped that additional funds will enable the force of this department to be increased.

Field observations of the habits of birds, however carefully made, are not wholly reliable, especially when the food consists of small insects, among which are some of the most important pests of agriculture. Final judgment of the value of a bird's services can be rendered only after the examination of the contents of an adequate number of stomachs. This is the court of final appeal. It is hoped that with the aid of additional examiners the work may be pushed as rapidly as its importance demands.

Professor Beal, chief assistant in this branch of the work, returned in December from California, where he had been engaged in investigating the food habits of birds in the fruit districts. The essential purposes of this work are to make exhaustive studies of the food habits of such birds as live in or near orchards, in order to discover to

what extent, if at all, these species injure fruit; and also to learn which birds render important aid to the orchardist by feeding upon insects known to attack fruit and fruit trees. The final object is to discover means of preventing the injuries of the harmful class and of augmenting the numbers of the useful class. A bulletin containing part of the results of these investigations has been published, and the second and final part is now far advanced toward completion.

Cotton boll weevil.—Investigations of the relation of birds to the cotton boll weevil were continued during the past year with excellent results, and several additional species were found to feed upon the pest. In all 43 species of birds are now known to feed on the weevil, and the combined assaults of this number, some of which evince a decided taste for the beetles, can not fail to have an important influence in checking the spread of the pest and ultimately in reducing its numbers. A report on the subject has been prepared which contains important suggestions for increasing the numbers of swallows, which prove to be among our most valuable allies in the war on the weevil. During the year two circulars were issued having the same general end in view. In one the attention of the northern farmer is called to the importance of the several species of swallows as general insect destroyers and to their special value to the cotton planter at this particular time, when the most important of southern industries is threatened by the boll weevil. The cooperation of residents of the Northern States is asked in order that the number of swallows in the North may be increased, to the end that after the birds have finished their work in the North, as they migrate to their winter quarters, they may serve the Southern States by attacking the boll weevil.

The second circular is addressed to residents of the Southern States and sets forth the nature of the services rendered by swallows in warring on all flying insects, but more particularly the boll weevil, and explains how the birds may be induced to extend their range over larger areas of cotton-producing territory and also how their numbers may be increased in districts which they already occupy. By the means suggested it is thought that the number of swallows, both in the North and in the South, can be substantially increased, resulting in a corresponding decrease in the number of weevils and other noxious insects.

Food of wild ducks.—Investigations of the food of wild ducks continue, with a view of aiding legislation in the establishment of a proper open season for this important group of food birds. Final conclusions are delayed by the difficulty of securing for examination the required amount of material. Considerable progress in the work has been made during the past year, and up to the present time over a thousand duck stomachs have been secured, rather more than half of which have been examined.

NUMBER OF STOMACHS EXAMINED.

During the past year 5,822 bird stomachs were received and 2,186 examined and their contents tabulated. In addition the stomachs of 1,533 birds from Texas were examined with reference to the number of boll weevils they contained.

SCALE-EATING BIRDS.

The usefulness of birds in warring upon the destructive scale insects has been so generally overlooked that special investigations have been made for the purpose of determining how many species of birds feed upon scales and to what extent these insects constitute the food of such species. As a result 57 species have been found to feed on scale insects—insects whose small size and sedentary habits might be supposed to adequately protect them. From the number, however, found in the stomachs of certain birds, like the grosbeaks, they seem to be specially relished and are regularly hunted for. No doubt further investigations will considerably increase the list of species that destroy scales.

Among the scales detected in the stomachs of birds are some of the most dangerous and destructive of the group. More than 30 kind of birds have been found to eat the black olive scale, perhaps the most dreaded of the family. An article on this subject was published in the Yearbook for 1906.

GROSBEAKS.—Work on the economic relations of the grosbeaks, begun in 1905, was completed during the past year, and a report on the subject is now in the hands of the printer. Some of the species are known to do more or less harm to certain crops, but taken all in all the grosbeaks are found to be an important group, the services of which to the farmer are of great value and entitle the birds to careful protection.

MEANS OF ATTRACTING BIRDS.

So long as our native forests continue to dwindle and as wild land is broken up for tillage, so long will certain of our native birds decrease in numbers, owing to the lack of food and of breeding grounds. It is important to counteract these and other baneful influences by providing in other ways for the welfare of our insectivorous birds. One of the more important of these is by furnishing an increased food supply by planting about houses and gardens fruit-bearing trees and shrubs, such as mulberries, cherries and others. Besides furnishing additional food for useful birds, such trees provide an economical means of protecting valuable fruit from the attacks of birds. Pending the publication of a report upon the subject, practical information as to the best kinds of trees for the purpose, under various climatic conditions, will be furnished on application.

GEOGRAPHIC DISTRIBUTION.

When the Survey began to investigate the economic relations of birds and animals, the recorded information as to the habits and distribution of even the commonest species was found to be surprisingly meager. Since a knowledge of the animals which collectively make up the fauna of a country is a necessary preliminary to a study of their economic habits, the Survey was confronted by the necessity of accumulating this information. One of the results of extensive field work was the surprising discovery that hundreds of previously unknown mammals and a considerable number of unknown birds inhabited North America. Since practically every

species has potential capabilities for good or harm to mankind through its relation to agriculture, it became necessary to classify the newly discovered birds and mammals as well as to study their habits and distribution. This pioneer work of laying the foundation for the more strictly economic investigations to follow has naturally decreased in amount year by year until comparatively little now remains to be done. The resulting publications, treating of special groups of animals, or special geographic areas, have proved of great educational value, are everywhere accepted as authoritative, and have done much to promote the intelligent study of our native faunas. The demand for copies is far in excess of the editions printed.

The field assistants engaged in studying the geographic distribution of animals and plants do not confine themselves to this feature of the work, but also collect as much information as possible in regard to the habits of the various mammals and birds in relation to agriculture and forestry. They are also detailed from time to time to make special investigations of a purely economic character. Thus, during the year, Vernon Bailey, in charge of the work on geographic distribution, made two special field trips to study the wolf problem—one at the request of and in cooperation with the Forest Service; the other at the request of residents of northern Michigan, Wisconsin, and Minnesota.

Arthur H. Howell made two trips to Texas, in fall and spring, to study the relation of birds to the cotton boll weevil.

W. H. Osgood was sent to Maine and adjoining parts of Canada to investigate the subject of fox farming and the rearing of other fur-bearing animals in that region.

H. C. Oberholser was engaged during a large part of the year in the preparation of an economic report on the birds of Texas.

E. A. Goldman was sent to the Salton Sea and Tulare Lake region of California to ascertain what species of waterfowl breed in these areas.

DISTRIBUTION OF TREES.

The extensive field work of the Biological Survey has resulted in the accumulation of an unprecedented fund of information as to the physical conditions and the distribution of plant and animal life in most parts of North America. This information has proved of value to other bureaus of the Department. During the present year, at the request of the Forester, the Chief of the Biological Survey has turned over for publication by the Forest Service a large amount of detailed information on the distribution of forest trees in California and Oregon. These data served to increase vastly the present knowledge of the geographic range of many trees of economic value.

LIFE ZONES AND CROP ZONES.

Extended field work has enabled the Biological Survey to demonstrate the existence and to define the boundaries of several distinct faunal and climatic belts extending roughly in an east and west direction across the continent and turning north and south along the flanks of the higher mountain ranges. Each of these belts is characterized by the presence of certain species of animals and plants, which are more or less strictly confined within its limits. The practical

utility of a knowledge of these belts depends upon the fact that a crop which is successfully grown in one section of one of these areas will do equally well under similar conditions elsewhere in the same belt. These belts are called life and crop zones.

In this undertaking the zone maps of the United States already published serve an important practical end. They are of great service also in an educational way in demonstrating the principles which should govern crop introduction.

In addition to zone maps of States and Territories, there is need of more detailed maps on a larger scale of particular areas within which special crops may be grown. The desert region extending from Salt River Valley in Arizona to the Salton Sea district of California is an example of such an erea. When funds are available, it is proposed to prepare maps of this and other special areas for the information both of the resident farmers and of those whose attention has been attracted by the agricultural possibilities of the region and who desire information as a guide to the selection of lands and of crops suited to these lands.

California.—Field work in California has been continued by the Chief of the Bureau and two assistants. It is planned to issue a life and crop zone map of this State, which is remarkable for the diversity of its climate and its capabilities for varied crop production.

New Mexico.—The field work in New Mexico necessary for the preparation of a crop and zone map is approaching completion. This work is in charge of Vernon Bailey, who, during the present season, has been temporarily assigned to other work.

Colorado.—Field work in mapping the zones of this State has been continued by Merritt Cary, and efforts will be made to complete it during the coming year.

DISTRIBUTION OF NORTH AMERICAN SHORE BIRDS AND BIRD MIGRATION.

Much preliminary work in the preparation of a bulletin on shore birds has been done by W. W. Cooke, who also has collected and classified a large amount of data on the migration of North American birds.

In addition to the work already mentioned, an advance has been made in digesting and arranging the accumulated data bearing on the distribution and habits of birds and mammals and putting it in condition for immediate reference. Work on the distribution maps has been pushed as rapidly as the exigencies of other and more pressing work permitted.

During the past year, at the request of colleges, museums, and private individuals, many specimens of birds and mammals have been identified to serve for educational purposes, for exhibition, and for study. Many county officers, when in doubt as to the identity of scalps of wolves and coyotes presented for payment of bounty, have forwarded the scalps and skulls to the Survey for positive identification.

GAME PROTECTION.

To the Office of Game Protection are assigned the duties arising under the Lacey Act of 1900, the Alaska game law of 1902, and the

egg act of 1902. These duties embrace (1) supervision of the importation of foreign wild animals and birds; (2) administration of Federal bird reservations; (3) protection of game in Alaska; (4) publication of information concerning game and various phases of game protection; and (5) enforcement of provisions of the law governing interstate commerce in game. The steady increase of work under the several lines makes greater and greater demand upon the limited force of the Office, and an increase will add greatly to its efficiency.

IMPORTATION OF FOREIGN MAMMALS AND BIRDS.

Careful supervision of the importation of mammals and birds into the United States has been maintained, and slight changes have been made during the year to secure greater efficiency. Each collector of customs is now notified by card of the issuance of a permit for an entry at his port, and all permits are made returnable to the Department by the collector if used and by the holder if not used, thus permitting more accurate check of entries. A personal examination of conditions governing importations at New York, Philadelphia, and New Orleans was made, and conferences were held with some of the leading importers.

The provisions of the law prohibiting the importation or interstate transportation of the mongoose, English sparrow, starling, and flying fox or fruit bat have become widely known, and vigilant scrutiny has revealed no attempt to introduce these proscribed species. Early in July, 1906, information was received that a consignment of strawberry finches had been landed in New Work without permit. Investigation through the Treasury Department disclosed the fact that the birds in question, 160 in number, had been brought over by a native officer on a vessel from Calcutta, and had been surreptitiously landed at night and sold to a bird dealer in New York City. A fine of $400 was imposed on the master of the vessel.

The importations of the year include a number of birds and mammals of unusual interest. The opening of the new bird house of the New York Zoological Society at Bronx Park was the means of bringing to the United States many rare birds, some of them for the first time, including 3 Sze-chuan pheasants (*Phasianus satschenuensis*). During the year two consignments of Prince of Wales pheasants, 4 nobilis pheasants, and 42 refulgent monsul pheasants, species rarely brought in, were entered at New York by dealers. A notable increase in the number of common species of pheasants imported was observable, owing chiefly to the great demand for English and ringneck pheasants for stocking purposes. More than 2,000 of the former were imported by the State game warden of Kansas. The stocking of depleted covers with imported game birds was responsible also for a large increase in the importation of European partridges and a slight increase in that of capercailzie and black game.

The importation of eggs of game birds for the purpose of stocking covers seems also to have grown in favor. While the number of eggs entered during the year (5,910) was not greatly in excess of that of the previous year, the spread of interest in this experiment is shown by the fact that the number of consignments received was 39 as against 5 in 1905–6.

The total number of permits issued was 494, an increase of 61, as compared with last year's issue. The year's importations numbered 708 mammals, 351,407 canaries, 5,248 pheasants, 4,867 other game birds, 47,010 miscellaneous birds, and 5,910 eggs of game birds. In addition, 876 mammals, 10,915 canaries, and 18,085 miscellaneous birds were brought in without permits, none being required by law. Of the miscellaneous birds 12,543 were parrots. For convenient comparison the importations under permit of the past five years are shown in the following table:

Year.	Number permits.	Canaries.	Pheasants.	Other game birds.	Miscellaneous birds.	Eggs.	Mammals.	Total.
1903	387	201,527	1,565	7,561	43,980	2,000	629	257,262
1904	318	205,400	661	5,646	35,323	2,858	1,470	251,358
1905	390	230,682	1,147	2,405	36,603	2,270	200	273,307
1906	433	274,914	1,528	5,215	40,640	5,564	654	328,515
1907	494	351,407	5,248	4,867	47,010	5,910	708	415,150

It is interesting to note certain fluctuations in the import trade in birds. A large decrease in the number of Australian birds brought in is noticeable owing to interruption of the trade at San Francisco by the earthquake and fire of 1906. An exception appears in the case of the attractive Lady Gould finches, of which the number imported increased from 4 to 68, received, however, at New York via Europe. The number of Cuban parrots imported under permits advanced from 1,000 to 2,800. The Java sparrow also shows a growth in favor, 9,808 having been entered during the year, as against 6,285 in 1905–6. Other notable increases in numbers over last year's importations were as follows: The African gray parrot advanced from 160 to 388; the Brazilian gray cardinal from 455 to 760; the cordon bleu of Africa from 200 to 462; and the rarer edelsinger from 11 to 22. On the other hand, the popular Japanese robin seems to have slightly lost favor as the number dropped from 4,539 to 2,752.

Hawaii.—Twelve permits were issued for the entry of 66 birds at Honolulu. The importations included 4 canaries, 6 parrots, 4 pheasants, and 52 miscellaneous birds.

BIRD RESERVATIONS.

Thus far seven bird reservations have been established by executive order, as follows:

Pelican Island.—The brown pelicans on this island in Indian River, Florida, were carefully guarded through the year. As usual the reservation was visited by several parties, attracted by the wild life. A growing interest is manifested in the opportunity afforded of observing so many of these singular birds pursuing their daily lives in a state of nature, and in time Pelican Island is destined to become one of the important attractions of Florida. Nesting began on November 1, 1906, somewhat earlier than usual, and during the season there was a second brood, as there had been in the previous year, although the first hatching, unlike that of the preceding season, was unusually successful. The second nesting of the present year was a failure. The eggs hatched and the young passed through the

first stages safely, but on April 2–4 there was a cold storm accompanied by high water which flooded the island, drowned all of the second brood, and killed some of the old birds as well. Within a week or ten days after this disaster the pelicans began nesting for the third time during the season. By June 1 there were about 100 nests with eggs and young. For some reason, however, in the middle of June all the old birds left the island and the abandoned young perished. As the first and only successful brood consisted of more than 2,000 birds the net result of the season's nesting was a substantial increase in the colony.

Breton Island Reservation.—The islands composing this reservation were visited and somewhat damaged by a severe tropical hurricane that swept the Gulf of Mexico in 1906. Breton Island, 6 miles in length, was split into three parts, and although normally standing 12 feet above water, was flooded throughout its whole extent. Many thousands of pelicans were destroyed by being dashed to the ground by the wind. A beneficial feature of the storm, however, was the extermination of the raccoons and muskrats, which had infested the island and which annually wrought considerable havoc among the nesting birds.

Stump Lake Reservation.—There was some poaching on this reservation during the fall of 1906, and it was found expedient to secure the appointment of the warden as a deputy United States marshal that he might have full power to arrest poachers. Three poachers were indicted at the May term of the court at Fargo, and later pleaded guilty and paid their fines.

PROTECTION OF GAME IN ALASKA.

Early in 1907 a bill making radical changes in the present Alaska game law was introduced in Congress. By its terms the issue of permits to ship trophies was placed in the hands of the governor of Alaska. Hunting licenses were provided for, and other changes shown by experience to be advisable were made. The bill passed the House, but was not called up in the Senate until too late for consideration. In consequence of this failure to establish a license system and relieve the Department of the supervisory duties assigned it by the act of June 7, 1902, the policy in regard to the issue of export permits remains unchanged. During the year 18 permits were granted—3 for the shipment of live specimens for exhibition and domestication, 8 for specimens collected for scientific purposes, 1 renewing an expired permit, and 6 for shipment of trophies secured several years previously or in remote regions of the Territory. During the year 3 shipments passed through the custom-house at Seattle, 2 of which were under permits issued during the fiscal year ending June 30, 1906 (permits to export trophies from Alaska usually expire at the end of the calendar year, and it frequently happens that such as are issued in the spring are not used until the following autumn). As 10 shipments were received at Seattle in the last fiscal year, there was a marked decrease in this year's transactions. No permits were issued to parties desiring to make hunting trips to Alaska or for the shipment of trophies from the Kenai Peninsula.

INFORMATION CONCERNING GAME.

Under authority conferred by the Lacey Act, requiring the collection and publication of useful information concerning the propagation, use, and preservation of game and other birds, various investigations have been continued, the results of which have been, or will be, published in the form of circulars or bulletins. The more important of these investigations are as follows:

GAME LAWS OF THE UNITED STATES AND CANADA.—The annual summary of the game laws of the United States and Canada was revised and a section showing the bills introduced in the various legislatures but which failed to pass was added. As usual prior to the opening of the hunting season, posters, showing close seasons and other incidental provisions relating to the hunting of game in the United States and Canada, were issued.

INDEX OF GAME LAWS.—Work on the index of game laws of the United States from the earlist colonial times to date was continued. During the year the game laws of Alabama, Florida, Montana, Utah, and Viriginia were indexed.

HUNTING LICENSES.—A special circular relating to the hunting-license system was issued, bringing the subject up to date.

HISTORY OF GAME PROTECTION IN FLORIDA.—A brief résumé of the growth and present status of game protection in Florida was published.

As the work of indexing the game laws of the different States progresses and more complete information is received game protection in other States and Territories will be similarly reported upon.

QUAIL DISEASE.—Within a year or two a highly contagious and rapidly fatal disease, closely resembling the dreaded grouse disease of Europe, has appeared among the quail of the United States, and has caused great mortality in consignments of quail from infected localities in Alabama, Kansas, and Indian Territory. In consequence of this outbreak an investigation of the disease was undertaken by the Bureau of Animal Industry in cooperation with the Biological Surevy. The preliminary results of the investigation appeared in Circular 109 of the Bureau of Animal Industry.

CAGE-BIRD TRAFFIC.—An investigation of the conditions governing the cage-bird traffic of the United States was made and the results appeared in the Yearbook for 1906.

GAME COMMISSIONERS AND WARDENS.—The third part of the series of publications relating to the preservation of game and birds has now been completed. It discusses the establishment and maintenance of officers and enforcement methods, and will soon appear as Bulletin No. 28. An article on the subject appeared in the Yearbook for 1906, entitled "The game warden of to-day."

GAME PROTECTION IN 1906.—The general review of game protection for the calendar year, which was prepared for the Yearbook as usual, for the first time included the number of wardens on duty in 30 States, statistics concerning wardens' compensation, and a list of important sentences inflicted for violation of game laws.

GAME PRESERVES.—All obtainable laws relating to the establishment and regulation of game preserves in the British colonies in Africa, Australia, and America have been collected and copies of them have been made for future use. Information concerning the management of these and other foreign game preserves has been secured, especially in relation to the sources of funds for maintenance of supervision. The work of listing the private game preserves of the United States and of securing information as to location, area, and so on, has made much progress during the year.

THANKSGIVING GAME.—As heretofore, information was secured from game wardens and others showing kinds and amounts of game and prevailing prices in the markets immediately prior to Thanksgiving Day.

HUNTING ACCIDENTS.—An investigation has been begun of the number and causes of fatal hunting accidents. Much material has been secured, which will be published in the form of a circular.

BIG GAME.—The damage to crops in New England from deer has received considerable attention. Much material has been secured showing the present distribution of this animal east of the Mississippi River. The restocking of New Jersey with deer and the conditions governing the shipment of deer in Maine during the hunting season also have been made subjects of special investigation.

IMPORTATIONS.—A card index of importations has been brought practically to date. Data on the earliest importations of various birds prior to 1900 (the date of the passage of the Lacey Act) will be secured for reference and for future use. The parrots and most of the game birds have been already covered.

WILD TURKEYS.—Special investigation has been made of the occurrence and distribution of wild turkeys in the Southern and Eastern States.

COOPERATIVE WORK.

Much attention was devoted to cooperative work with Federal and State officers and private organizations. Aid was rendered the customs officials at New York in determining the question as to whether imported guinea fowls should be classed as game or poultry. Bird reservations are always policed in cooperation with the National Association of Audubon Societies, which also furnishes boats for the use of wardens—one launch for Pelican Island, two launches for Passage Key, and a sailboat for Breton Island reservation. Without this aid protection of the bird colonies on these islands would be out of the question, and it is only proper that the Department should bear a larger share of the expenses of the reservations.

Most of the cooperative work performed, however, is in connection with the establishment and maintenance of efficient game and bird protection by State game commissioners and wardens and others interested in preserving game and birds. By special request facts were presented to the Alabama legislature derived from the experience of the Department in matters relating to game protection. Special trips for similar purposes were made to Connecticut, Delaware, New Jersey, New York, Tennessee, Virginia, and Vermont.

Assistance was rendered also to California, Missouri, Texas, and Wisconsin. Two visits were made to Pennsylvania, on request of the State game officials, in connection with a prosecution for selling cardinals (or redbirds) and mocking birds in violation of the State law. Two purposes are subserved by work of this character—the hands of State officials are strengthened by the support of the Department, and the Department is brought into closer relationship with State officers and organizations.

INTERSTATE COMMERCE IN GAME.

The seizure in Los Angeles in November, 1906, of a carload of hides and horns of elk afforded evidence of the wholesale manner in which animals have been slaughtered for trophies or for tusks in some of the Western States in recent years. The Department was at once appealed to for assistance, and through the cooperation of officers of the Forest Service, the State wardens of Idaho and Wyoming, and the county warden of Los Angeles County, Cal., considerable evidence regarding the operations of the hunters was brought together. Two noted tusk hunters had been arrested at the time of the seizure and were held for the action of the Federal grand jury in Idaho on charges of shipping the trophies from St. Anthony and Sugar City, Idaho, to Los Angeles, in violation of the Lacey Act. Indictments were obtained at the April term of court at Pocatello and the two defendants entered pleas of guilty and were fined $200 each, the maximum fine under the Lacey Act.

The case, however, brought to light violations of several other laws besides the Lacey Act, including the Yellowstone Park act, the Wyoming law prohibiting killing and export of game, the law of Idaho prohibiting shipment of hides from the State, and the California law prohibiting possession of elk. Vigorous prosecution of these offenders under the various laws will doubtless go far toward discouraging such violations of the law.

The warden of Stump Lake Reservation having reported that he had placed under arrest three of the poachers who had been operating on this reservation, the matter was taken up with the Department of Justice and pushed to a conclusion. The offenders were promptly convicted and were fined $25. It is hoped that this action will materially aid in preventing further poaching on this reservation.

Investigation of conditions in the Southwest has not yet been made, stress of other work and the lack of funds making impossible a much-needed personal study of the principal field of illegal shipments of game. If possible, however, the investigation will be made this year and means will be devised to lessen, if not entirely stop, the illegal trade now prevailing.

ROUTINE WORK.

As the field work increases and includes new lines of investigation, the amount of routine work increases correspondingly. This consists of correspondence; the preparation of reports and bulletins on special subjects for publication; the identification and labeling of specimens, including those collected by our own assistants and also

those sent in for identification by colleges, museums, and various individuals; the storage and care of field collections; cataloguing and identifying the contents of bird stomachs; tabulating field reports; sorting and filing published matter for future reference; mapping distribution of birds, mammals, and plants; supplying the needs of field assistants; developing photographic plates and making prints therefrom; compiling game laws; issuing permits for the entry of foreign mammals and birds, and for the export of trophies and specimens from Alaska, and cooperation in enforcing the various provisions of the act of Congress of May 25, 1900. The letters received during the year numbered about 7,400; the letters written during the year numbered 6,200, and about 700 migration schedules were sent out to observers. During the year nearly 900 negatives were made, illustrating and furnishing a most valuable supplementary record of the field work of the Survey. The collection now numbers about 11,000 negatives.

PUBLICATIONS.

The publications for the year include 1 number of North American Fauna, 2 Bulletins, 4 Yearbook articles, 2 Farmers' Bulletins, 8 Circulars, the Report of the Acting Chief for 1906, and 9 reprints of former publications.

The number of North American Fauna (No. 26) contains a Revision of the Skunks of the Genus Spilogale, by Arthur H. Howell.

The Bulletins are: No. 26, Distribution and Migration of North American Ducks, Geese, and Swans, by Wells W. Cooke; No. 27, The North American Eagles and Their Economic Relations, by Harry C. Oberholser.

The Farmers' Bulletins are: Methods of Destroying Rats, by David E. Lantz; Game Laws for 1906, by T. S. Palmer and R. W. Williams, jr.

The articles in the Yearbook are entitled: Cage Bird Traffic of the United States, by Henry Oldys; Birds that eat Scale Insects, by W. L. McAtee; The Game Warden of To-day, by R. W. Williams, jr.; Game Protection in 1906, by T. S. Palmer.

The titles of the Circulars are: No. 53, Directory of State officials and organizations connected with the Protection of Birds and Game, 1906, by T. S. Palmer; No. 54, Statistics of Hunting Licenses, by T. S. Palmer; No. 55, Directions for the Destruction of Wolves and Coyotes, by Vernon Bailey; No. 56, Value of Swallows as Insect Destroyers, by H. W. Henshaw; No. 57, Birds Useful in the War Against the Cotton Boll Weevil, by H. W. Henshaw; No. 58, Destruction of Deer by the Northern Timber Wolf, by Vernon Bailey; No. 59, Game Protection in Florida, by R. W. Williams, jr.; No. 60, List of Publications of the Biological Survey.

The reprints of former publications issued are as follows: Bulletin 21, The Bobwhite and other Quails of the United States in Their Economic Relations, by Sylvester D. Judd; Yearbook articles: Four Common Birds of the Farm and Garden, by Sylvester D. Judd (two reprints); Federal Game Protection, by T. S. Palmer; Birds as Weed Destroyers, by Sylvester D. Judd; The Blue Jay and Its Food, by F. E. L. Beal; Meadow Mice in Relation to Agriculture, by D. E. Lantz; The Danger of Introducing Animals and Birds, by

T. S. Palmer; Some New Facts about the Migration of Birds, by Wells W. Cooke: Game Protection in 1905, by T. S. Palmer.

Reprints of the following Circulars were issued: No. 17, Bird Day in the Schools, by T. S. Palmer; No. 56, Value of Swallows as Insect Destroyers, by H. W. Henshaw; No. 57, Birds Useful in the War Against the Cotton Boll Weevil, by H. W. Henshaw.

In addition to the above a report, entitled "Wolves in Relation to Stock, Game, and the National Forests," was prepared by Vernon Bailey, at the request of and in cooperation with the Forest Service, and published as Bulletin No. 72 of that Bureau.

OUTLINE OF WORK FOR 1908.

ECONOMIC ORNITHOLOGY AND MAMMALOGY.

Work in economic mammalogy will be continued along much the same lines as in previous years. It is intended to continue experiments with a view of preventing or greatly limiting the damage to stock by wolves and coyotes, including experiments for the purpose of devising a cheap and effective wolf and coyote proof fence.

Owing to the sudden irruption of enormous numbers of field mice in some of the alfalfa fields of western Nevada, the discovery of a cheap and effective method of destroying these pests by wholesale is important. Hence field experiments with traps, poisons, and gases will be conducted for the purpose of ridding the infested areas of these animals. Laboratory and field experiments in cooperation with the Bureau of Animal Industry, to test the efficiency of an imported virus for the destruction of rats and mice, will be continued. In connection with this work, attempts will be made by means of field investigations to obtain cultures of diseases known to prevail at irregular periods among rabbits, field mice, and other rodents. The field and laboratory experiments with a bacterial virus for the destruction of grain-eating ground squirrels, in cooperation with the State experiment station at Pullman, Wash., will be continued, as also experiments with mineral and other poisons for the same purpose.

Three preliminary reports on the relation of birds to the boll weevil have been issued. The work will be continued in Texas and Louisiana, and will be extended into Mississippi, should the pest reach that State, as now appears probable.

Field work in connection with the investigation of the food of California birds, with special relation to the protection of fruit-bearing trees, has been practically completed for the northern part of the State, and examination of the stomachs necessary for completing Part II of the final report on the subject is progressing satisfactorily. Part I is now in press and will be issued during the year. Work of the same nature will be pursued in Oregon and Washington.

Supplemental investigations in relation to the English sparrow are being carried on and will be continued during the year. It appears probable that the pest has about reached the limits of its extension. The limit of its increase in the regions where it has become established also seem to have been reached. Apart from its destructive raids on small fruits and grain, the bird everywhere does much harm by driving away our insectivorous birds, and requests

are constantly being received from farmers and other landowners asking for means for destroying it on a large scale.

Of late years the diminution in the numbers of our game and water birds has been the occasion of much concern among sportsmen and others interested in the wild life of our country. An increasing number of those who seek needed recreation in the pursuit of game, and the demand for game as food, which constantly increases with increasing population, are chiefly responsible for this poverty of game birds in regions where formerly they teemed. As a result of the pressing demand for more agricultural land, projects are now being formed for the drainage of extensive swampy areas, as the Dismal Swamp of Virginia, the Everglades of Florida, and other similar tracts. The conversion of swamps into land fit for agriculture is sure to result in still further reducing the numbers of certain species of ducks, geese, and waders, and in greatly hastening their threatened extinction, both by destroying their natural food supply and their nesting grounds. It is important that a study of the local faunas of these regions and of local conditions should be made with a view to the discovery of means of averting the threatened harm to our native waterfowl. In this connection attention is directed to extensive irrigation projects now being carried out in the Western States. Lakes are being formed as feeders to irrigation canals, and it may prove practicable to offset in part, at least, the destruction of present breeding grounds of ducks and geese by the utilization of artificial lakes. The problems presented are likely to prove comparatively simple and of easy solution. By planting certain rushes and grasses around the margins of artificial lakes conditions may be produced closely approximating natural ones. The presence of suitable nesting sites, a supply of natural food, and protection from man are all that are necessary to assure the colonization of such lakes by waterfowl. In this way irrigation ponds and lakes may be made natural preserves and resorts for our waterfowl and waders, and the threatened extermination of certain species may be averted.

Beaver farming.—The beaver, formerly one of the most widely distributed of our mammals and numerous over extensive regions, has everywhere diminished in numbers and in many localities is extinct. Its fur became a valuable article of commerce almost from the time of the first settlements, and it is no less valuable now than formerly. Several States already have laws protecting the beaver, and the natural results of protection are seen to follow in a speedy increase of numbers. No doubt, under protective laws carefully enforced, the animal in time can be induced to reoccupy much of its old territory and thus become a permanent source of profit. So few and small have the colonies become, however, owing to ruthless and persistent trapping, that to insure the perpetuation of this valuable fur-bearing animal, it will probably be necessary to go further than mere protection and to colonize suitable ponds and streams. Experiments in this direction by private parties on a small scale have already proved successful, and in view of future commercial possibilities it is believed that the industry is of sufficient importance to warrant the comparatively small outlay necessary for experiments on a larger scale.

In addition to its commercial value, the beaver may prove of service as an aid in the storage of water along the courses of tributary mountain streams, owing to its well-known habit of damming such streams for the express purpose of forming artificial ponds and lakelets, which act as natural storage basins.

Fox farming and mink farming.—The value of our fur bearers constantly increases as the natural supply of furs diminishes under an ever-increasing demand. Many experiments have been made from time to time in raising foxes for their skins. Some of these have been rewarded with a fair measure of success. Others have failed from lack of capital, failure to supply the proper food, want of the necessary care, or other causes. Several of the fox farms of Maine and the Canadian provinces were visited during the past season by an assistant of the Survey, with a view to a thorough study of the problem. It is believed that the raising of foxes for their fur is entirely practicable and that it can be made lucrative in many localities. It is intended to continue this investigation and to undertake practical experiments in the rearing of mink in confinement for their furs. While by no means so valuable as the higher grade of fox skins, the fur of the mink is sufficiently valuable to insure good profits from their culture. Most of the experiments in raising mink have proved unsuccessful, more, however, from lack of the proper food and care of the animals in confinement than from difficulties inherent in the nature of the undertaking.

Dike borers.—In cooperation with the Reclamation Service it is intended to investigate the nature and extent of the damage done to dikes by certain rodents, such as muskrats and gophers, with a view to the discovery of methods of prevention. Much damage to irrigation dikes has already been done by these animals, and extensive irrigation projects now under way in various parts of the West invest the subject with growing importance.

GEOGRAPHIC DISTRIBUTION.

Field work will be continued in several of the Western States and Territories. The surveys of New Mexico and California already are well advanced. The survey for a zone map of Colorado also is approaching completion. In addition, field work is planned for the present year in parts of Arizona, Oregon, Montana, and North Dakota.

Several assistants will be detailed to continue investigations already begun of special economic problems. These include the relation of birds to the boll weevil in the cotton belt; the distribution and abundance of water fowl in the marshes of California; an economic report on the birds of Texas; and continued cooperation with the Forest Service in the study of the wolf problem on the stock ranges. Work on a report on the shore birds will be continued, and it is hoped will be ready for the press before the end of the year. The compilation of data on the migration of birds regularly received from a large number of correspondents and from published records will be continued. Whenever time can be spared from other work the mapping of the distribution of birds and mammals will be carried on.

In addition to the lines of work already detailed there is another which each year takes more time. This is the examination and identification of specimens sent in for the purpose by colleges and museums, by farmers, fruit raisers, and others interested in knowing the names of the birds and mammals that live about their homes, and which in many instances are beneficial or injurious to their crops.

GAME PROTECTION.

IMPORTATION.

The plan of making every unused permit returnable to the Department within thirty days, put into operation at the end of the year, will be continued, and in combination with the return by collectors of customs of used permits, adopted last year, will afford a serviceable check on the number of birds and animals entering the country. The consolidated card index of species imported since the Lacey Act became effective, June 1, 1900, now practically completed, will be kept up to date and will furnish a valuable record.

Attention will be devoted to improving the service on the Pacific coast. Withdrawal of the direct line of steamers from Australia to San Francisco has resulted in making Victoria, British Columbia, the port of entry for Australian birds. On this account the inspection service at Puget Sound ports of entry needs to be strengthened.

The conditions of the import trade at San Francisco will be examined, and efforts will be made to secure more exact information as to parrots and other birds entered without permit, particularly those brought from Mexico. The work of ascertaining the dates of earliest entry of different species into this country will be continued.

INTERSTATE COMMERCE IN GAME.

Duties concerned with interstate commerce in game constitute the main part of the field work undertaken in connection with the preservation of game. During the latter part of the summer of 1907 a personal examination will be made of conditions governing illegal shipments of game in the Southwest. The virtual repeal of the machinery for enforcing the Missouri law this year greatly increases the difficulty of preventing violations of the Federal law in neighboring States, particularly in Illinois, Nebraska, Kansas, Oklahoma, Arkansas, and Texas, and the main field work of the year will be directed to this region. The new laws of Alabama and Texas will demand closer supervision of matters relating to game protection in the South.

Cooperation will be had with Western States in preventing illegal traffic in hides, horns, and tusks of big game, in following up violations already reported to the Department, and in prosecuting cases already begun. This field of labor derives added importance from the fact that the laws passed by the Wyoming legislature this year offer rewards for the apprehension of illegal killers of big game. Since nearly all such illegal destruction occurs in the National Forests the Federal Government is directly concerned.

Attention is again called to the necessity for the creation of three districts, each with a supervisor, with headquarters at Chicago, St. Louis, and Baltimore. The cost of such service would not exceed $2,000 per annum, and the result would be the establishment

of a thorough and effective means of enforcing the provisions of the Lacey Act. The work has been carried on as actively and vigorously as possible by the present limited force and with the present appropriations, but it has been impossible to conduct it with the proper degree of thoroughness. In dealing with local conditions a representative of the Department on the spot is worth a dozen correspondents, however willing or capable. The results of efforts made under present conditions have been good as far as they go, but they do not suffice to interpose a systematic and effective check on violations of the Lacey Act. As before pointed out, the services of the suggested supervisors would not be required during the entire year. Their services would be in demand chiefly during the open season for game, a period not generally exceeding six months and in many instances much shorter. It is earnestly hoped that the funds needed may be forthcoming.

GAME AND BIRD REFUGES.

Supervision of the bird reservations established by the President will continue in cooperation with the National Association of Audubon Societies. This organization is making a systematic survey of the Louisiana coast from the mouth of the Mississippi River westward and also a reconnoissance of points along the South Carolina coast where birds are likely to breed. The purpose of these investigations is to locate such breeding colonies of birds as can be protected by the establishment of Federal bird preserves or of refuges maintained under State auspices. It is hoped that in the near future, as one result of these investigations, two additional Federal bird reservations will be established on the Gulf coast.

Investigation of public preserves, both in the United States and abroad, will be continued. Exigencies arising in connection with the preservation of birds and game require the constant extension of the "game-refuge" or "bird-sanctuary" idea, and study of the most effective methods is necessary. As soon as possible the results of these researches will be published.

The work begun two or three years ago of collecting information concerning private preserves will be further prosecuted with a view to publication during the year. New legislation of several of the States in 1907 shows the importance of this investigation. Vermont, New York, Pennsylvania, North Carolina, Indiana, Illinois, and California passed laws relating directly or indirectly to private preserves.

INFORMATION CONCERNING GAME.

It is the present purpose, if limited time and force permit, to issue publications during the coming year that will inform the public of practically all provisions of the game laws of the various States and Territories. Those relating to seasons, sale, shipment, and licenses will be covered by the usual annual summary of these provisions; those relating to enforcement will appear in a bulletin now ready for publication. In addition to these it is hoped to prepare and publish the provisions concerning nongame birds and those relating to prohibited methods of hunting. The four volumes will then furnish a complete compendium of the essentials of the game laws of the United States.

Besides knowledge of existing laws, it is desirable that those concerned with the enforcement of legal enactments should have ready

access to judicial decisions in cases that have arisen under the game laws; work on the index of such decisions, now nearly completed, will be pushed as rapidly as possible, and the completed index will be placed in the hands of the printer at the earliest possible moment.

Various important matters connected with game will form the subjects of other publications. Statistics of fatal hunting accidents during the past year have been secured and will soon be prepared for the press. Efforts will be made to devise a feasible plan of ascertaining approximately the number of certain species of game remaining in each of the States and Territories and the number annually killed. Attention will be directed especially to the present distribution of the antelope, wild turkey, prairie chicken, and several others whose numbers are rapidly decreasing or whose range is undergoing a change.

It is the desire of the Department to cooperate with and assist those States especially that have no organized State warden service, by systematically distributing publications to individuals and organizations interested in game, and by study of local conditions and of the special needs in each case. The recent publication of a brief résumé of the course of game protection in Florida was along this line. A similar sketch of game protection in Virginia is in course of preparation and will be published soon.

RECOMMENDATIONS.

In submitting estimates for the fiscal year 1909 the following recommendations are made:

(1) That an increase of $2,200 in the statutory roll be granted, to be applied as follows: One thousand two hundred dollars for an additional clerk, whose services are needed in the work of game protection; $1,000 for the employment of an additional clerk whose services are needed in the work on economic mammalogy and ornithology.

(2) That an increase of $15,750 in the lump appropriation be granted, to be applied as follows: One thousand five hundred dollars for the employment of an additional scientific assistant in crop and life zone investigations; $1,000 for the employment of one additional assistant in the work of economic ornithology and mammalogy; $1,200 for the employment of one district supervisor; $1,000 for traveling expenses for district supervisor; $1,000 for field investigations in relation to methods of combating the ravages of rodent mammals (especially ground squirrels), including studies of epidemic bacterial diseases; $750 for field investigations in relation to the control of the cotton-boll weevil; $500 for experiments and field work in relation to fox farming in Alaska and elsewhere; $300 for field work in the Eastern States in relation to damage to berries and small fruits by birds; $1,000 for field work in relation to damage to stock by wolves, coyotes, and other predaceous animals; $1,000 for field investigations of the distribution of the diseases of quail and other game birds; $500 for traveling expenses in connection with game protection; $5,000 for field work in locating the boundaries of crop belts and for work on geographic distribution, chiefly in California, Colorado, New Mexico, Utah, and Arizona; and $1,000 for expenses of inspection of imported birds and mammals.

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